NPS-SM-95-001

NAVAL POSTGRADUATE SCHOOL

Monterey, California

Understanding Videoteleducation: An Overview

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January 1995

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Prepared for: Naval School of Health Sciences, Bethesda, MD

NAVAL POSTGRADUATE SCHOOL
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REPORT DOCUMENTATION PAGE

Form approved

OMB No 0704-0188

1. AGENCY USE ONLY (Leave blank)

2. REPORT DATE
January 1995

3. REPORT TYPE AND DATES COVERED
Technical Report 10-94 to 1-95

4. TITLE AND SUBTITLE
Understanding Videoteleducation: An Overview

5. FUNDING
N0622A95WR60017

6. AUTHOR(S)
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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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555 Dyer Rd.
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8. PERFORMING ORGANIZATION REPORT NUMBER
NPS-SM-95-001

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Naval School of Health Sciences
Building 141
8901 Wisconsin Avenue
Bethesda, MD 20889

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words.)

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14. SUBJECT TERMS
videoteletraining, videoteleducation, distance education

15. NUMBER OF PAGES
46 pages

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	

UNDERSTANDING VIDEOTELEDUCATION: AN OVERVIEW

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ABSTRACT

This research examined selected distance learning and videoteleducation (VTE) literature to determine the factors Navy health care executives, administrators, and instructors should consider before implementing VTE technology. The literature and interviews with VTE users revealed the lack of an explicit theoretical framework or conceptual scheme to root VTE research findings. To remedy this fundamental problem, this report provides a conceptual scheme of VTE use based on administrators' and instructors' mental models of learning. Furthermore, the scheme examines how these models influence administrators' and instructors' conceptualization of VTE; VTE design, support, training, and rewards; VTE measures of effectiveness; and the rules that evolve about VTE and its uses. Finally, the report provides five major lessons learned about VTE that are derived from the literature review.

PREFACE

This technical report reviews selected literature in the area of videoteleducation (VTE). The research was undertaken primarily to examine the challenges, opportunities, and potential roadblocks of using electronic media to offer management education to health care executives in Navy hospitals. This VTE assessment is part of a program sponsored by the Navy Bureau of Medicine and Surgery in which The Naval Postgraduate School, Department of Systems Management, will provide graduate-level education necessary for senior medical department officers of all corps (Medical, Dental, Medical Service, Nurse) to manage in the ever-changing Military Health Services System.

The secondary goal of this research is to provide useful information for university faculty administrators and instructors considering implementing a VTE program or teaching in one. This report should be helpful to those who are unfamiliar with VTE and desire an overview of VTE technology, its implementation, and the lessons learned from research. Also this report will be useful to those interested in the conceptual and practical issues that affect VTE design, human resource support, and measures of VTE effectiveness.

UNDERSTANDING VIDEOTELEDUCATION: AN OVERVIEW

Distance education through electronically transmitted media is becoming widely used nationally and internationally by educational institutions, business organizations, and the military (Pugh, Parchman, & Simpson, 1991). Derived primarily from teleconferencing, this potentially groundbreaking educational application is also called videoteletraining (VTT), interactive television (ITV), or videoteleducation (VTE). Throughout this paper we will use the term VTE to describe this new medium.

PURPOSE

This VTE research was undertaken primarily to examine the challenges, opportunities, and potential roadblocks of using electronic media to deliver management education to senior medical department of all corps (Medical, Dental, Medical Service, Nurse) in Navy Hospitals. The possibility of using VTE to provide management education for potential navy health care executives is part of a program sponsored by the Navy Bureau of Medicine and Surgery in which the Naval Postgraduate School, Department of Systems Management, will deliver the management education necessary for Medical Department Personnel to manage in the ever-changing Military Health Services System.

Our second aim was to provide useful information for university faculty administrators and instructors who are considering implementing a VTE program or instructing in one.

To achieve these two aims, we examined a representative sample of the distance learning literature, interviewed experts in distance education and instructors with VTE experience, and

attended two academic conferences that had a significant number of sessions devoted to distance learning issues.

We have organized this report in the following manner:

1. A brief examination of why VTE is appealing to administrators.

2. An overview of typical VTE system design.

3. The background on the evolution of VTE and a discussion of its widespread use.

4. An analysis of the radical departures from traditional education this medium both reflects and creates.

5. An examination of the influence administrators' and instructors' mental models toward learning have on VTE conceptualization; design, support, training, and rewards; measures of effectiveness; and rules about its use.

6. A review of lessons learned from the VTE literature.

7. Final observations and recommendations.

THE APPEAL OF VTE

Educational administrators and policy makers find VTE appealing for several reasons. The ability to deliver education to remote sites makes education accessible to a large number of potential students (particularly part-time, older, non-traditional students) unable to take classes "on campus" because of job demands, family responsibilities, travel costs, and time constraints. This democratization of education appeals to legislators because it makes academic institutions seem aware of and sensitive to the needs of legislators' constituents.

Educational democratization due to VTE also has global implications. Given current

telephone and satellite links, virtually any postsecondary institution in the world can enhance its curricula by supplementing them with VTE instruction. Global access to instruction can help provide developing nations with the scientific, technical, and managerial expertise necessary to improve living standards. Furthermore, VTE and other types of information networks can generate opportunities for knowledge creation and information sharing among diverse peoples from different cultures (Rossman, 1992).

Another appealing feature of VTE is its ability to extend the presence of the college or university into the workplace. Recognizing the need for business organizations to provide their workers with continual and convenient education to meet new work environment demands, entrepreneurial administrators have used distance education to delivers tailored training and education programs at employment sites, sometimes even persuading business executives to underwrite the cost of VTE equipment. Not only does customized education and training create new, money-making markets but it also can result in partnerships with businesses, research opportunities for faculty, an increase in alumni donations, and the perception that academics are capable of meeting the needs of the business community.

Finally, many administrators see VTE as a low-cost method of delivering education. One instructor can teach large numbers of students in numerous locations.

OVERVIEW OF TYPICAL VTE SYSTEMS

VTE comes in various combinations of video, audio, and graphics. Systems designed to create potential for a large amount of interactivity between instructors and learners have two-way

audio and video and graphics capabilities. Other systems, where interactivity is seen as less crucial to learning, use one-way video and two-way audio. Furthermore, systems can be point to point--one location to another location--or point to multi-point: one location to a variety of other locations. Students may or may not be present with the instructor at the originating location. Finally, VTE classrooms can be configured to promote various forms of instruction: lecture, demonstration, and small group interaction.

In all VTE systems, video and audio signals are compressed prior to transmission, sent digitally via a broadband (T1) telephone line(s) or satellite and are decompressed into an analog format for display on the television monitor at the receiving end. A device called a codec compresses and decompresses the video signal. The quality of the codec and the bandwidth of the transmission media determine the quality of the received video image. Only top-of-the-line codecs and a dedicated video line will produce sharp picture resolution and natural looking movement. Because of cost, many universities do not use these very high quality codecs and dedicated video telephone lines or satellite. This results in some loss of picture resolution and a somewhat jerky quality in the movement of people and objects. In short, the quality of the video image and naturalness of movement depends on the quality of equipment. There is also a slight time lag between a spoken transmission and the time when the listener/viewer hears the message.

While the time lag of the audio and the quality of the video can cause negative learner attitudes and pedagogical difficulties for instructors, the extensive use of VTE by academic institutions and the military suggests that VTE program implementers believe that limitations are minor compared to the benefits.

THE EVOLUTION AND USE OF VTE

Distance education is not a new phenomenon; its history dates back to correspondence courses offered by mail. By the 1870s, correspondence courses were popular in many countries, including the United States and by 1900, distance education was a flourishing enterprise.

As early as 1933, college courses in Iowa were broadcast over radio to reach remote learners. In fact, for a number of years primary and secondary school students living in the remote areas of Alaska, Montana, and the Dakotas have been taught at home via radio and television.

The desire to reach professionals at their workplaces prompted Stanford in 1969 to begin offering courses using Instructional Television. At this same time, the Open University of the United Kingdom was created to provide distance learning opportunities through the combined use of televised instruction and traditional home-study techniques. Soon afterwards, Canada's Athabasca University developed its own distance education program.

Britain, Canada, and Australia were initially the dominant figures in distance education implementation. Although the United States was heavily involved in the early correspondence programs, we were slow in the 1960s and the 1970s to incorporate audio and video distance education programs. However, in the early 1970s the University of Alaska and California State University, Chico took the lead in experimenting with different modes of distance education delivery. Prompted by the desire to reach remote students, the University of Alaska began to experiment with audio transmissions in 1971 and video in 1975. Similarly, in 1975 California State University, Chico, developed a system to offer televised courses across the northern part of the state. By 1984, the

Chico campus enabled students to earn the M.S. degree in computer science through off campus offerings.

Today, numerous academic institutions offer not only VTE courses but also award undergraduate and master's degrees to students who may never set foot on campus. For example, instructors at the University of Hawaii have conducted foreign language instruction by "electronically merging" American and Japanese students who can interact in each other's language. States such as Oregon and Wyoming are networking their universities, comprehensive colleges, and community colleges so that learners in disparate locations can take advantage of instruction that the entire state higher education system has to offer. Some accrediting agencies such as AACSB have taken a hands-off approach toward distance education, only stipulating that VTE courses meet for the same number of hours and have the same quality as resident courses; others have yet to establish policy.

University consortia have also entered the distance education arena. For example, the National Technological University, a consortium of university departments of engineering, began in 1984 to offer courses for engineers at their employment sites. These engineers can update their skills or earn advanced degrees by taking electronically delivered courses from the best universities (Stanford and MIT for example) in the nation.

Many corporations, for example IBM and AT&T, use VTE to conduct extensive college programs for their oversees employees, and many business organizations collaborate with universities in other countries so their employees can receive VTE instruction. For example, in 1981 the Hewlett Packard Corporation created a network to link Palo Alto with more than a hundred sites around the country. As a result, students in Scandinavia pursue doctoral studies, taking courses from universities in more than one country and spending very little time on the campus that actually awards the degree.

These farsighted organizations have recognized that providing their workers with continuous learning opportunities through partnerships with academic institutions gives both the students and the organizations a competitive advantage. The Department of Defense, which has often taken the lead in experimenting with and implementing new instructional technologies, has embraced VTE. Driven by the need to provide its work force with up-to-date training and education while reducing travel costs and keeping people on the job, the Navy has established the CNET Electronic Schoolhouse Network (CESN), The Air Force its teletraining network (ATN), and the Army has the Army Teletraining Network (TNET). The Air Force Instructor Training School has recently included a one-half day VTE teaching effectiveness module in its instructor training program to meet the needs of Air Force Institute of Technology teachers who use VTE fairly extensively in their programs.

The Navy has supported a great deal of VTE research through The Navy Personnel Research and Development Center (NPRDC) since about 1990 (see, for example, Simpson, 1990; Simpson, Pugh, & Parchman, 1990; and Simpson, Pugh, & Parchman, 1992). Recently, NPRDC has tested the learning effectiveness of VTE using hands-on laboratories, small group interactions, and other non-lecture applications. NPRDC researchers were particularly interested in determining whether VTE could be used effectively to teach their Navy leadership course for Division Officers, Chief Petty Officers, and Leading Petty Officers. Their results will be published in the near future.

MENTAL MODELS THAT AFFECT VTE DESIGN AND USE

Although distance learning in the form of VTE is becoming more widely used, both experienced users and those considering VTE implementation may tend to think of it and use it as a

form of high-tech lecture. As a result, there is real danger that administrators and instructors will continue to interpret VTE processes, procedures, and the need for resource support in the framework of traditional classroom instruction. This perception of VTE use can significantly limit instructional applications and teaching processes.

This rather pedestrian use of VTE is not surprising. The research literature in instructional technologies charts a history of unimaginative use of new technologies. Although there has been a tendency to embrace enthusiastically new technologies--the allure to appear different, innovative, and at the same time cut costs has been powerful--these technologies have often been used merely to replicate traditional instruction. For example, early computer-based instruction represented "automated page turners."

What we are implying is that administrators' and instructors' mental models or interpretive schemes about technology, learning, and communication have and will continue to influence VTE conceptualization, system design, instructional methods, instructor support and training, reward systems, measures of instructor and learner effectiveness, and rules about VTE use.

Mental models (sometimes called master scripts, interpretive schemes, schemata, and theories-in-use) are shared assumptions, images, stories, and generalizations about how the world operates that shape how we perceive and interpret experience (Bartunek, 1984; Senge, 1990). These models are active; they function as internal control systems that can steer and structure behavior.

Mental models are neither correct nor incorrect; they are by definition ways of simplifying and categorizing the rush of experiences and ideas into our theories about the world. What is problematic is when mental models are tacit, existing below the level of awareness of an individual, department, or organization. This lack of awareness can significantly delimit thinking and action, thus causing an

ossified response to new ideas, opportunities, or technology. Another result from unexamined, deeply entrenched mental models is a widening gap, or, to mix a metaphor, a misfit between our own models and those of our stakeholders. This gap can make our actions and approaches to problems seem inappropriate to our stakeholders, or simply wrongheaded, though they appear reasonable and perhaps even perceptive to us. In the next sections we examine the mental models that influence VTE perception and discuss the practical implications of those models.

VTE Mental Models: Information Conduit and Knowledge Construction

Two mental models shape VTE administrators', instructors', and researchers' thinking about VTE:

> **1.** VTE as a conduit that efficiently transfers, carries, or delivers information from instructors to students
>
> **2.** VTE as a medium with attributes that may produce a range of reciprocating interactions between instructors and learners. These interactions can generate the possibility for both instructor and students to discover, create, and shape new knowledge and learning.

VTE is conceptualized by many as an instructional conduit or vehicle (Clark, 1983; Wetzel, Radtke, & Stern, 1994). The sources for this conceptualization are the lecture view of instruction and the information-as-commodity view of learning that sees learners as relatively passive recorders and storers of information. Since lecture is still the primary pedagogy used in colleges and universities, despite recognition of the value of experiential learning, this belief still dominates university education and thinking about how learning occurs.

However, this instruction as information transfer model has a more rudimentary source. Its origins are rooted in thinking reflected in most sender-receiver communication models that represent communication mechanistically as the "transfer" of information between sender and receiver. In these

models communication media function merely as "conduits," "pipelines," or "vehicles" for that transfer. Furthermore, as both Axley (1984) and Reddy (1979) convincingly show, the language we use to discuss communication and communication media is dominated by conduit and information transfer metaphors and that this language structures thought and influences behavior.

Pervasiveness of the VTE as Conduit View

Support for the dominance of the information conduit view of VTE comes from many sources. Most VTE instruction has relied on lecture (Miller, McKenna, & Ramsey, 1993) where instructors transmit the same information to remote sites as the traditional classroom setting receives. In fact, Schall and Stuart (1990) comment in their review of distance learning literature that even though the technology has changed radically in recent years, VTE is still a dull "talking head" medium in which conventional lectures are televised. Initial uses of new technologies strongly influence future uses; consequently, we may continue to see VTE used primarily as a way of conveying lecture-based instruction.

Not surprisingly, VTE research has also been grounded in lecture-based courses (Wetzel, Radke, & Stern, 1994). These studies have compared the relative effectiveness of various forms of VTE media (for example, two-way video and two-way audio; one-way video and two-way audio) with face-to-face instruction as "vehicles" or conduits for "delivering" lecture-based instruction (Clark, 1983). The pervasiveness of the influence of the conduit model on VTE research design is well demonstrated by Clark's review of research:

> The best current evidence is that media are mere vehicles that deliver instruction but do not influence achievement any more than the truck that delivers our groceries causes changes in nutrition . . . only the content of the vehicle can influence achievement (Clark, 1983, p. 445).

The findings from these comparative studies are consistent. There is no statistically significant difference in student performance at remote sites compared to face-to-face residence sites; no matter how instruction is "delivered," similar amounts of learning result (Wetzel, Radtke, & Stern, 1994; Russell, 1992). Russell makes this point dramatically:

> No matter how it is produced, how it is delivered, whether or not it is interactive, low-tech or high-tech, students learn equally well with each technology and learn as well as their on-campus, face-to-face counterparts even though students would rather be on campus with the instructor if that were a real choice.

However, two important points must be made about this research. First, VTE research is still in a formative stage. There exists a relatively small body of quantitative VTE research and virtually no qualitative research using ethnography, participant observation, naturalistic inquiry, or other methodologies. Much of what is published consists of anecdotal descriptions of lessons learned. Second, and perhaps most important, researchers have yet to consciously apply or create theoretical frameworks or models to guide research design or interpret results (Wetzel, Radtke, & Stern, 1994). As a result, researchers doing VTE studies have often unwittingly appropriated the mental model of learning as information transfer to guide their research designs and their measures of effectiveness.

VTE as a Means for Constructing Learning

A fundamentally different mental model conceptualizes VTE as a medium that can be configured in multiple ways to produce a range of interactions between instructors and learners. Within this VTE conceptual scheme there is an array of appropriate media clusters that can be used with respect to various learning outcomes, pedagogy (lecture, discussion, role play, case analysis, etc.), and learner characteristics. This mental model presupposes that knowledge and learning are socially constructed, not transferred or passed on, through the interactions of a community of

learners. Within this mental model the teacher/student dichotomy is dysfunctional, dampening interaction, blocking listening, and curtailing learning. These interactions generate the possibility that learners can discover, create, and shape new knowledge and learning.

The dominant metaphor is that of a web in which a large array of VTE media possibilities can generate various types of shared understanding. Furthermore, certain media are "richer" than other media based on the media's ability to provide quick feedback, generate multiple cues (body language, proxemics, eye contact, etc.), use natural language, and convey social presence through personal focus (Trevino, Daft, & Lengel, 1990). And just as importantly, new media use occurs within a web of social relationships and influences based on direct statements about the media by influential co-workers and people in positions of authority, the rewards and visibility afforded to new media users, group behavioral norms, individuals' cognitive styles, prior experience with media, and symbolic features ascribed to the media (Fulk, Schmitz, & Steinfield, 1990). Unfortunately, only Kozma (1991) has conceptualized VTE in this manner and our review of VTE literature has not uncovered research that examines VTE from this conceptual framework.

A Conceptual Scheme of VTE

As we have stated in the previous section, our mental models about learning, instruction, and technology influence our conceptualization of VTE use. This conceptualization impacts our thinking and actions about VTE factors such as system design, support, training, rewards, measures of VTE effectiveness, and rules about VTE and its use. The relationships among these variables are shown in Figure 1, and this section discusses those relationships in the context of the practical implications that result as a function of the mental model one holds.

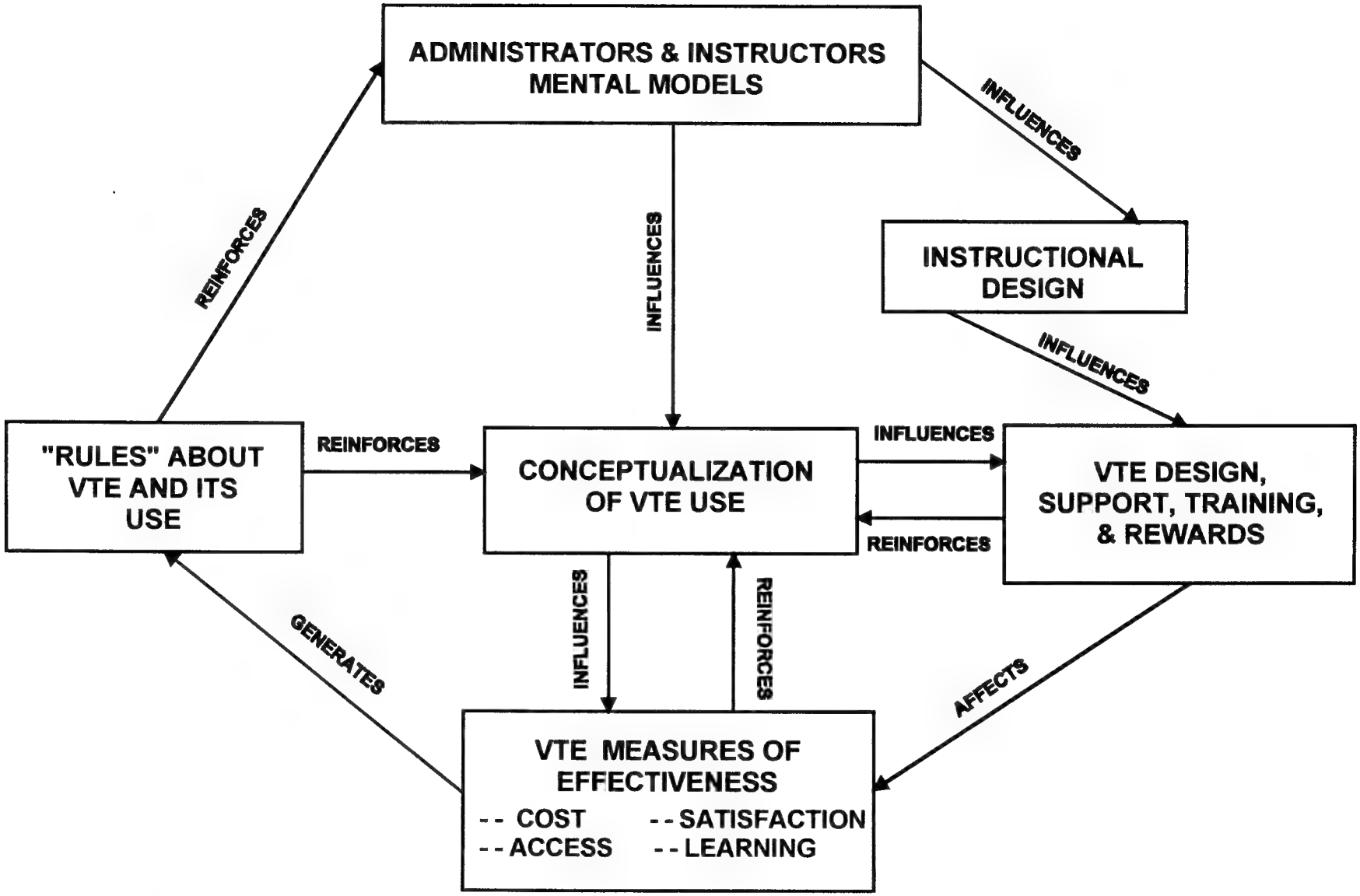

FIGURE 1. A Conceptual model of VTE use.

The Relationship among Mental Models, Instructional Design, and VTE Conceptualization.

Mental models influence instructional design, which in turn influences instructional media choices; as a result, the role that VTE, or for that matter any medium, plays to support design concepts will vary. For example, when learning and communication are seen as the simple transfer of information--the instruction as information transfer mental model--instructional design becomes simply a set of practical issues concerning the efficient transfer of that information (e.g., when, where, how much, etc.). Instructional media then function as information conduits; consequently, VTE design issues focus on developing the least costly, easy-to-use system that can transfer instructors' lectures to remote locations. In fact, there are now attempts to "convert" traditional courses to VTE and to create generic "conversion models" (Simpson, 1993). The design principles behind the conversion model--mimic live training, minimize personnel and support requirements, and minimize production complexity--imply that VTE technology is largely a conduit that can duplicate "traditional courses" if the right conversion algorithms can be found.

Interestingly, if the resulting VTE system design is perceived as effective (how VTE is conceptualized will determine what measures of effectiveness are used), that will reinforce conceptions of how VTE can be profitably used, which in turn will reinforce the mental model that spawned instructional design assumptions. In short, the relationship among mental models, VTE conceptualization, and VTE design is reciprocal or recursive. Mental models influence VTE conceptualization, both of which influence VTE design; in turn, a VTE design perceived as effective reinforces conceptualization of VTE use, which reinforces administrators' and instructors' mental models toward learning, communication, and technology.

In contrast, departing from the traditional "knowledge transfer" classroom model can be seen

as moving along a continuum away from lecturing to passive students toward a high level of interaction among all participants represented most fully by "action learning." The mental model that sees learning as "knowledge construction" recognizes the need for large amounts of instructor/learner interactivity (communication), which in turn leads to more complex instructional design considerations. Within the constructivist learning framework, VTE is seen as a medium capable of "connecting" learners, instructors (actually facilitators), and information so that they become a closely spun web. The challenge of VTE design is to create a web that supports and facilitates rich interaction among learners, instructors, and information.

Designing instruction within the context of a constructionist model requires one to consider three primary variables:

> (1) What is going to be taught, that is, what is the expected learner outcome? For example, one may be trying to change attitudes, teach intellectual skills, train motor skills, and so on.
>
> (2) Who are we teaching, what are the characteristics of the learner in terms of learning style, background, intelligence, or experience?
>
> (3) How are we going to teach these outcomes to these students? What specific conditions need to be established to ensure that learning occurs, and what pedagogy will support those conditions as well as which media can support the pedagogy?

To illustrate the interactive relationship between media, pedagogy, and learning outcome, we can use Gagne's theory of instruction (1984), which is based on five categories of learning outcomes that characterize human performance. We will use three of Gagne's categories to show that learning process and, hence, the array of media necessary to facilitate that process is affected by learning outcome.

For example, a student learning verbal information (e.g., management competencies) might be expected to state those competencies to demonstrate that she has learned. For this outcome a

lecture followed by an exam and feedback would be adequate. To support the lecture-based teaching method to generate this learning outcome, a relatively inexpensive one-way video link with compressed motion and two-way audio may be all that is necessary. In fact, one could argue that a taped lecture with e-mail for student/instructor interaction are all the media needed to support this type of learning.

However, if the student is learning higher-order intellectual information (e.g., concepts associated with various management theories), the student will need to demonstrate mastery of those concepts in various ways such as generating an example of the concept or creating a more complex theory by combining two simpler ones. To help create this learning outcome, instructors may need to use a combination of lecture, discussion, question/answer, and case analysis to illustrate the theories and to determine if students can synthesize concepts. These instructional methods and means of determining learning outcomes require a significant amount of interactivity. To create that interactivity, high quality two-way video and a two-way audio may be necessary, the equipment in the resident and remote locations must be configured to promote interaction, and instructors or technicians must be skilled in using the media (eye contact, shot selection/proxemics, instructional material) to generate that interaction. Therefore, instructor-learner and learner-learner interactivity is a variable linked with learning outcome and pedagogy.

Finally, if students are to learn cognitive strategies, they must learn to apply verbal and intellectual information to new situations (e.g., finding a novel approach to a problem). The process of finding novel approaches to complex problems is iterative and collaborative requiring significant amounts of interaction and feedback between instructor and students. To enable students to develop these cognitive strategies, instructors can use role playing, simulations, group discussion and debate,

dialogues, and cases. Generating the rich interaction required to help students develop and test their "strategic knowledge" may require not only full motion two-way video and two-way audio but also creative use of equipment (e.g., appropriate shot selection, shot length, and so on), careful room set up, and strategic use of instructional materials.

As we have seen, learning outcome is an important variable that needs to be aligned with instructor/learner interactivity, pedagogy, and the array of media. Another important factor that affects this alignment is learner characteristics. Specifically, learners' prior knowledge, their learning style, their interpersonal skills, their experience with different media, and their ability to process various combinations of visual, linguistic, and auditory information influence what they learn and how they learn it. The research findings on learner characteristics have yet to be applied to VTE research.

Viewing learning as "knowledge construction" in contrast to "information transfer" can result in a fundamentally different way of conceptualizing VTE use. In turn, seeing VTE as a communication web that helps generate interactivity among learners, instructors, and information creates complex VTE design issues that, as we will see in the next section, require special training and support.

Training and Support.

If VTE, or any medium, is viewed as a conduit for information transfer, then only a limited amount of special training and support--beyond what is needed in lecture-based instruction--is needed when VTE is added to the classroom. However, if VTE is designed as an interactive web, then instructors and learners need to understand how classroom processes will change when VTE is introduced--both instructor and student effectiveness in the traditional classroom will not necessarily equate to effectiveness in the VTE environment. Furthermore, adding a highly interactive VTE

system will require additional support and subject-matter expertise.

Many VTE researchers agree that VTE instructors should be subject to systematic selection processes (Shaeffer & Farr, 1993) and that those who are selected need special training before conducting a VTE course (Greydanus, Root, & Pribyl, 1991; Wolf, 1994). Furthermore, to design the VTE course to promote instructor/learner and learner/learner interactivity, and to generate materials that are both visual and reader friendly at remote sites, VTE instructors need to work as a team with technical (media) and graphics specialists (Bowman, 1994; Wolfe, 1994). However, instructors are often assigned to VTE classes a month before classes are to begin, are given only a quick orientation on how to operate the equipment, and receive neither training in teaching in front of a camera nor help or instruction in preparing VTE materials. Often the results are unpleasant for instructors and less than ideal for learners. Administrators have often not provided training or technical and graphics support and instructors did not ask for it because both assumed that teaching in the VTE classroom was similar to teaching in the traditional classroom; the only difference was that the camera and microphone transmitted instruction to remote sites.

Reward Systems.

How VTE is conceptualized also influences reward systems. For example, the constructionist view recognizes that VTE instruction demands more effort compared to traditional, lecture-based education; consequently, an appropriate reward system would include at least initially more course design and material preparation release time for VTE instructors (the "Lessons Learned" section provides more details about VTE workload). However, in some institutions there also exists a normative bias toward VTE instruction. Some VTE instructors (e.g., Willis, 1991) have found that their institutions view VTE as second-class education; that bias is reflected in inadequate instructor

rewards (release time, formal and informal recognition, salary increases, etc.) for VTE teaching.

Measures of Effectiveness.

As the model in Figure 1 shows, VTE design, support, training, and rewards will influence measures of effectiveness, which in turn can strengthen or weaken one's conceptualization of VTE use and mental model of learning and communication. Influence occurs in two ways. First, the conceptual scheme of VTE influences the selection of measures of effectiveness. Second, the design, support, training, and reward systems will affect the results of the measures of effectiveness. These relationships are discussed next.

The literature reviewed in this research reflected the predominance of the conceptual scheme of VTE as a conduit for information transfer. In all studies examined except for research by Kozma (1991) and Miller, McKenna, & Ramsey (1993), the model was tacit; its influence was not discussed or tested. The primary measure of learning effectiveness in these studies reflected an information transfer and knowledge retention view of learning: students' ability to provide correct answers on fill-in-the-blanks, multiple choice, or short answer exams (Miller, McKenna, & Ramsey, 1993; Rapinski, 1991). Implicit within this measure is the belief that students "extract" knowledge from instructors and accurately "re-present" it. However, if one adopts a constructionist view of learning, teaching complex skills and behaviors will require more sophisticated forms of evaluation.

Other measures of effectiveness that have been used with VTE include access (the conclusion that learning is a success if VTE provides an opportunity that would not otherwise be available), and student satisfaction, which was originally called the "reaction" measure of learning by Kirpatrick in 1960 and has been criticized by many when it is used as the only form of evaluation because of its unreliable relationship to measures of learning retention and transfer.

Administrators' view of VTE as a conduit can be reinforced because they primarily see VTE as a way of reducing educational costs including student travel and per diem expenses. Clearly, if one views VTE as a mere vehicle for information transfer, the most attractive benefit of using the medium will be the costs saved by transporting information to a virtually unlimited number of students at one time.

With respect to the results of evaluation measures, decisions about system design, support and training resources allocated, and reward systems are directly related to cost and access. These variables are also related to satisfaction and learning, although these relationships are more difficult to define and demonstrate. For example, interactivity and student satisfaction seem to be directly related (Simpson, Pugh, & Parchman, 1991b; Simpson, 1993), but the size of the relationship and the relationship between satisfaction and learning are not clear.

Rules.

Finally, as a result of this ongoing, recursive interaction between our mental models, our conceptualization of VTE, and our actions, we generate "rules" about VTE. These rules reinforce and sustain our conceptualization of VTE and our mental models about learning and instruction. Furthermore, other organizational members new to VTE draw on these rules to guide their thinking and action, which not only supports and legitimizes previous action but also helps sustain the prior conceptualization of VTE and dominant mental model about learning. The following scenario helps clarify this complex interaction.

An example of a VTE "rule" would be that only the most innovative, talented instructors who interact well with learners will be asked to teach VTE classes and they will be provided the resources they believe necessary to learn to teach well in the VTE environment. What could have generated

this "rule" is a series of interacting factors. Specifically, a department chair believes that VTE media offer challenging, creative teaching possibilities, novel ways of generating learning in instructors and students, and the opportunity to penetrate new student markets and form partnerships with business organizations (her mental model toward instruction that influences how she conceptualizes VTE). This administrator carefully selects her initial VTE instructors based on their instructional innovation ability. She also devotes resources to system design, instructor training, and technical as well as graphics support. Furthermore, these pioneering VTE instructors are provided ongoing rewards such as funding to attend VTE conferences in appealing locations, release time, better computer equipment, praise, and external visibility. Finally, both the administrator and instructors agree that student satisfaction and improved analytical capabilities will be measures of effectiveness; data are collected to benchmark these measures. The courses goes well, both instructors and students are pleased, publicity is generated by the success, organizational stories circulate about who teaches VTE classes, and the rule becomes strengthened along with the processes that generated it. Obviously, other rules about VTE and its use could be generated as a result of different scenarios that would create a distinctive series of influences and interactions of the variables outlined in our model. Other examples of VTE rules could reflect the following: VTE should reach the largest number of students possible at the lowest cost, VTE should be used for only lower-level undergraduate courses, teaching VTE courses is less important than teaching in residence graduate seminars, teaching VTE classes is inappropriate for Junior faculty because it gets in the way of research, VTE should only be used for lecture-based courses, and so on.

In any case, design, support, training, rewards, measures of effectiveness, and rules associated with given instructional applications may be very simple and straightforward or very complicated

depending on the underlying mental model and conceptual scheme of VTE. As we have shown, the information transfer view of learning simplifies these factors and their relationships. However, the social constructionist (knowledge construction) model of learning is messy, inconvenient, and provides no simple answers to important VTE questions such as:

1. What kind of learning outcome is expected, what instructional methods support that learning, and what degree of instructor/learner interactivity is needed to facilitate that learning? To what extent does this interactivity promote instructor learning?

2. Who are the learners and what are their characteristics: prior knowledge, preferred learning styles, ability to process visual information, and so on?

3. What array of media are needed to support the instructor/learner interaction required by learning outcomes, teaching methods, and instructor/learner needs?

4. How should VTE be used? What kind of equipment (size of video screens, types of microphones, etc.) aids in achieving the desired interaction?

5. What kind of technical, graphics, and logistics support do instructors need? Is a team-based approach needed to generate the instructional materials and to support learning?

6. How much and what kind of training do VTE instructors need? How much course preparation time should VTE instructors be provided?

7. Who should teach in the VTE environment? Is "camera appeal" a factor in determining who should be placed on the air?

8. What are appropriate rewards for VTE instruction? Should instructors who teach VTE classes have lighter loads because VTE instruction causes high instructor stress? Should VTE instructors be celebrated because of their innovation?

9. What measure or combination of measures determine VTE effectiveness: short- or long-term instructional cost reduction, learner satisfaction, increased access to education, instructor satisfaction, retention and transfer, department visibility because of instructional innovation?

Lessons Learned by VTE Users

Although well-designed, empirical research about VTE is in short supply and VTE research lacks a theoretical framework to ground its results, the studies we have reviewed, the VTE instructors we have spoken to, and the conference sessions we have attended provide a number of "lessons learned" from VTE experiences. This section reviews those lessons learned that we consider to be the most important.

Teachers Need Special Training Before Using VTE

Empirical and anecdotal evidence strongly support the view that teaching with VTE is a significant departure from traditional classroom instruction; good classroom teaching does not necessarily translate into good VTE teaching. Wolfe (1994), in a review of VTE instructor lessons learned at the US Air Force Academic Instructor School, stated that "...television requires unique skills that go beyond traditional classroom teaching methods and styles." (p. 1) Instructors who are very effective in the traditional classroom may not be successful in the VTE environment (Bailey, Scheppe, Hodak, Kruger, & Smith, 1989).

Many instructors will need training to overcome their initial fear of being on camera and seeing themselves on a monitor. Biggs (1994) reported that instructors at the Defense Language Institute felt initially fearful and intimidated about using VTE and that, in spite of years of classroom experience and confidence in their teaching abilities, the idea of a camera in the classroom made them feel very self-conscious. If fear inhibits communication between instructor and students, learning will suffer and student satisfaction will decline. Consequently, instructors need training in VTE-specific skills, and they must be given the opportunity to practice and develop them so that they can replace

their fear of the camera with confidence in their ability to use the camera to further their instructional ends.

The amount of training and the kind of skills instructors need varies depending on VTE system design, perceptions of its use, measures of VTE effectiveness, and most importantly resources available. For example, Henry Simpson states that most instructors can be "converted" to VTE instructors very easily and with little training; they need several hours of familiarization with the equipment and several days of practice (Simpson, 1993). This training may be sufficient because Navy instructors are required to use a highly structured, often scripted approach when teaching. The Army, with similar training requirements and instructional approaches, suggests that instructors practice one iteration of an entire course before they broadcast (Schall & Stuart, 1993). New VTE Instructors at the Defense Language Institute were given a two-week introductory course prior to using VTE (Biggs, 1994). However, this training did not alleviate the fear of being in front of a camera, of looking unattractive, or of being dependent on the technology.

In contrast, Professor Joel Bowman, Chair of the Department of Information Management at Western Michigan University, attended a one-week training seminar in how to teach in front of a camera as part of his preparation for his VTE Managerial Communication course for MBA students. This course is very interactive and focuses on the development of middle-level managers' cognitive communication strategies and attitude change toward communication and leadership. Bowman indicated this instruction was essential to deal with his anxiety about being on camera (he felt he would look unattractive), to understand how to use shot selection to mimic proxemic distance, to learn verbal and visual strategies to generate interactivity with students, and to run case discussions and role playing exercises. In addition, Bowman formed a three-person VTE learning team that

included a graphics expert and a VTE technical expert to help prepare for his course. In all, Bowman spent approximately 3-4 weeks "training" to teach the course, not including practice time. Bowman believes this up-front investment is essential for first-time preparation of a highly interactive VTE management course. (Bowman, 1994).

The University of Wyoming attributes the success of their distance learning program, in part, to a systematic development program for instructors that includes targeted recruitment (faculty do a "screen test" before being selected to teach VTE courses), pre-course discussions, seminars and workshops, and on-going coaching. Many who are experienced in VTE recommend soliciting feedback from colleagues on a regular basis as part of a continuous VTE education and development program. In addition, the University of Oregon, which has linked its two-year colleges, four-year colleges, and universities through both one-way and two-way video and audio, provides new instructors with training in areas such as personal performance, establishing rapport, questioning strategies, course design, and preparation of visuals (Greydamus, Root & Pribyl, 1991).

What Teachers Need to Learn to Use VTE

Clearly, instructors must become familiar with the VTE technology. However, the degree of familiarity needed depends on whether instructors use an equipment operator or operate the equipment themselves. This decision depends on VTE system design (e.g., robust VTE systems have control rooms, multiple cameras, zoom lenses, low and high key lightening, VCRs, and a variety of other communication devices), and the degree of interactivity the instructor requires to support the learning outcomes and teaching approaches.

If an instructor is "delivering" a lecture, has basic equipment, and demands minimal camera movement to help generate interactivity, then the instructor can operate the equipment herself.

Consequently, she needs hands-on training to prevent mishaps and to develop confidence with the technology. Schall and Stuart (1993) report that instructors have been known to terminate the entire transmission while trying to switch the video from one site to another. They may push the wrong buttons, forget which buttons to push, or even roam too far and break the wire of a lavaliere microphone!

However, if the instructor has a robust, studio quality VTE system and is attempting to generate a large amount of interactivity among participants and create a rich visual environment through use of slides and tapes, then an operator is necessary to determine shot selection, change shots, track the camera, insert tapes, and so on. The instructor, however, needs to know what impact shot selection, screen size, body movement, camera angle, and so on will have on how she appears visually at the remote sites.

There are also a host of issues mentioned in the literature that the novice VTE instructor should become aware of (see, for example, Lochte (1993). These range from procedures that can be easily changed to changes in style that may be very difficult for instructors to even think about. Listed below are some of the most important factors:

1. VTE magnifies speaking errors; distracting expressions such as "uh" "you know," poor grammar, and speaking too rapidly seem over exaggerated by the camera. Consequently, VTE instructors need to speak clearly, grammatically, and slowly.

2. Movement and gesture are magnified on screen because of the size of the video monitor and shot selection, particularly close-ups. Consequently, VTE instructors need to move relatively slowly and smoothly and to be aware that, say, a grimace to a student question will be magnified when seen on screen at remote locations and may impact student morale and willingness to interact.

3. The instructor needs to listen actively, repeating questions to ensure not only they but other learners have heard and understood. Listening can be problematic in the

VTE environment because instructors can easily be distracted or preoccupied by the technology.

4. Before each class, students at remote locations may need to be "primed" to interact because of the distance barrier and the artificiality of the VTE environment (Biggs, 1994). This priming can be done by chatting with these students before class, directing questions early in class to specific students, and beginning with a brief interactive exercise.

5. Instructors need to explain to students how to use the technology.

6. VTE is a visual medium; consequently, a variety of visual materials need to be generated--tapes, diagrams, pictures, viewgraphs--to provide learners with visual stimuli. Also, camera position, shot selection, camera movement, and so on create rhythm and pace in the VTE remote sites and also serve as markers that signal breaks in content or transitions between segments (Wetzel, Radke, & Stern, 1994).

7. Instructors must dress for the camera. Pastel colors are preferable to solid white or darkly colored clothes, small patterns and wide stripes should be avoided, and jewelry--particularly items with reflective surfaces--should be kept to a minimum.

8. Instructor affect strongly correlates with student satisfaction; however, every VTE system, no matter how sophisticated, will filter non-verbal cues that generate that affect. Consequently, instructors must guard against appearing aloof or uncaring and must make a concentrated effort to project sincerity, objectivity, approachability, preparedness, dedication, confidence, and friendliness (Wolfe, 1994). These affective qualities also help generate interaction.

Selecting VTE Instructors

VTE instructors need to be chosen with care. Instructors who are intimidated by the technology or who believe that technology is an intrusion into the educational process should not be pressed into VTE service. Students quickly recognize the fear or dislike of the technology, which affects learning and student satisfaction.

Ideally, VTE instructors are careful planners yet flexible and innovative in their use of teaching methods. Furthermore, they should be willing to give up the control that lecture-based instruction

affords, to view the classroom not as their "sacred space" but as a learning forum. Some researchers (Bailey, et al. 1989; Wetzel, Radtke, & Stern, 1994) claim that instructors need to acquire acting ability or be charismatic (Biggs, 1994) to be effective VTE instructors. These researchers base their claims on expectations created by years of television viewing; students may expect instructor quality to be comparable to the carefully scripted, cleverly produced programs they view on commercial television. A western state college, which has an extensive VTE MBA program, has replaced instructors who were subject matter experts but who were "not liked by the camera" with more "camera lively" instructors who were less knowledgeable (Dulek, 1994).

VTE Instruction Is More Demanding than Face-to-Face Instruction

VTE researchers have found that VTE teaching is time consuming, difficult, tiring, and demanding (Biggs, 1994; Clark, 1983; Schall & Stuart, 1993). Professor Bowman, who taught an MBA VTE Managerial Communications course originating from Western Michigan, stated that he never worked harder, longer, and more intensely preparing for his VTE class. He added that the short-term institutional rewards, despite the release time and training he received, did not match the effort. However, he believed the intrinsic rewards were more than worth the effort. He felt that his team had created something novel, they were responsible for its success, and the MBA students had important insights into media (media choice and its impact on managers is an important area of study in managerial communication classes) that they could not have gained in a face-to-face classroom environment. Furthermore, Bowman believes his ability to design and teach highly interactive VTE classes gives him a competitive advantage and ensures that he will not become "an academic dinosaur" (Bowman, 1994).

Professor Ball of the Naval Postgraduate School (NPS) Aero and Astro Engineering

Department recently completed an 11-week course in Aircraft Combat Survivability that was offered to resident NPS students and students at the Naval Air Systems Command in Virginia. When asked about his VTE experiences, Ball stated that although he had taught this same course, face-to-face, about 60-70 times before, teaching the course using VTE made a big difference. He said having the camera in the classroom introduced a formality, which made teaching more stressful. He found it to be an exhausting experience with the quarter being the hardest of his teaching career (Ball, 1994).

Ball's stress and his feeling spent after teaching a 1-hour VTE class could be partially caused by other factors than merely being on camera. Ball had to operate the VTE equipment himself. Consequently, while lecturing and scanning both the on-site and remote class to monitor student understanding, he also operated several cameras and several other pieces of media equipment. Doing this effectively required him to be thinking about camera movement and placement as well as the lecture points he was trying to make. Professor Ball noted that even toward the end of his 11-week course, it was still difficult to remember to put the camera on the graphics transmission device when he was going to write or draw something in response to a student question. The result was that the students could see his face but not the information needed to answer the questions. Another cause of stress that some VTE instructors have experienced was described by the chancellor of the University of Maine as a response to the change represented by having the privacy of one's classroom--an instructor's sacred space--invaded by monitors that are recording, displaying, and potentially preserving every word, gesture, or expression (Graham, 1990).

Other requirements made Ball's experience demanding. The planning, materials preparation, and logistics requirements of the VTE course--new course materials had to be developed and all materials used had to be sent to remote students far enough in advance--required that Ball spend

about twice the time on the VTE course as a traditional residence course (Ball, 1994).

Defense Language Instructors also found that preparing for VTE language classes was labor intensive, requiring far greater preparation time than traditional classes. In fact, instructors felt that VTE's greatest weakness was the significant preparation time required to teach well. The added preparation time was needed to generate visually oriented media such as graphics and video segments; also, instructors had to work hard to develop innovative teaching techniques to generate student/instructor interactivity (Biggs, 1994).

A number of studies suggest that distance education requires enhanced planning and management skills on the part of both faculty and support staff (e.g., Willis, 1992). Many have pointed out that you can't just "wing it" like you can in a traditional classroom. They point out the need for the initial training to learn to work with the system, more time required to prepare graphics (standard overheads often cannot be used for remote students, so graphics created for traditional classes will not be usable), and the need to send materials in advance.

While some place high value on flexibility and spontaneity in the electronic classroom, others feel that their work in front of a camera needs to be more scripted than in the traditional classroom. Where the teacher must operate the equipment while teaching, the ability to "think on your feet" can be inhibited, in turn, requiring more preparation. Bailey, et al., in their review of the literature in 1989, concluded that VTE could take significantly more time for additional planning and preparation even with the content already developed. Willis (1991) says that effective distance education programs, "...are planned with an attention to detail often exceeding that required in traditional face-to-face teaching." (p. 11).

More Support Is Needed for VTE

To mitigate high instructor work load, extensive clerical support is required. Successful VTE programs typically centralize support service functions including duplicating and distributing materials (course syllabi, tests, handouts, etc.), ordering and distributing textbooks, sending and receiving graded requirements, tracking admissions and maintaining records, providing timely media and production services, and scheduling and troubleshooting technical resources. For example, determining the right graphics to use on VTE and constructing them so they will be easy to see and read at remote locations can require significant expert support. As noted earlier, transmitting graphics involves different requirements than merely showing an overhead at a local site.

Work Teams Can Mitigate Individual Workload,Enhance Learning About VTE, and Result in Creative VTE Design

Unlike the traditional educational model of instructor as sole creator of student learning, VTE instruction and design virtually demands a team-based approach, particularly if instructor learning objects require high levels of instructor/learner interactivity. The rationale for this new design is fairly obvious: graphics, technical, and instructional expertise are all needed to create an effective course, support staff is required to handle important logistics requirements, cross disciplinary learning needs to occur quickly to generate creative solutions to VTE challenges, and the VTE workload needs to be shared.

VTE instructors for the Air Force work with teams of graphics and technical audio and visual design experts to create their VTE offerings. Professor Bowman at Western Michigan stated that creating a VTE course is a collaborative undertaking requiring multiple perspectives to create learning in a visually rich environment. He teamed with graphics, video, and audio experts to plan, create, and

offer a Managerial Communications VTE course. This collaborative effort resulted in integrative learning and new, combined ways of thinking about relationships between camera distance, shot selection, instructor platform techniques, eye contact, graphics presentation and a host of other factors. Bowman claimed he has never learned more about a diverse range of factors in a relatively short time (Bowman, 1994).

Instructor and Student Attitudes Toward VTE

The research indicates that students who have had prior experience with distance learning perceive their VTE experience more positively than students who have had no prior experience. Furthermore, student perceptions of VTE become more positive after repeated exposures to the technology (Silvernail & Johnson, 1992). In general, students at remote sites are less satisfied with their learning experience than students in face-to-face classes, even though, as we pointed out earlier, there are no statistically significant differences in student learning (Rupinski, 1991).

The cause of VTE student dissatisfaction appears to be the lower level of perceived student-teacher interaction at remote sites. However, it's not clear if this lower level of interaction is caused by ineffective pedagogy, system design that makes interaction difficult, instructors not taking advantage of system interactive capabilities, students being intimidated by the technology, the communication filters and barriers inherent in remote video and audio transmission, or a complex interaction effect between or among these and other variables.

Interactivity and student satisfaction seem to be inversely related to numbers of students and number of sites. As the number of students and the number of remote sites increases (which makes VTE more cost effective), the instructor, particularly one that is required to operate the VTE equipment, will find it increasingly more challenging to use the technology to connect with students.

Due to this decreased interactivity, student satisfaction declines (Rupinski & Stoloff, 1990).

As our model indicated, VTE design affects student satisfaction as a measure of effectiveness; consequently, care needs to be taken in VTE design to ensure the potential for high levels of student-instructor interactivity. However, there is a major mitigating factor in this relationship between VTE design and student satisfaction: student access to instruction. Although students distant from a university often mention they miss face-to-face instruction, they appreciate the opportunity to take university courses in their own communities and thus are more than willing to overlook differences between VTE and traditional education (Shaeffer and Farr (1993).

Instructor attitude toward VTE has been mixed. Faculty who had substantial media experience in college teaching were significantly more favorable to the concept of distance education than those reporting little or no experience. Similarly, faculty who had VTE teaching experience were significantly more favorable to VTE than those who did not have experience (Clark, 1993).

Faculty attitude toward distance education also varies according to type of academic institution. Not surprisingly, faculty at research universities were, in general, negative toward distance education; spending the extra time preparing for VTE classes would take time away from their research efforts. Faculty at comprehensive colleges, which tend to balance teaching and research requirements, were only somewhat negative to distance education. Finally, faculty at two-year colleges, where teaching is the primary measure of effectiveness, viewed distance education positively (Clark, 1993).

Rupinski (1991) found that even after experience teaching a VTE class, military instructors still preferred the traditional classroom to the VTE class; however, instructor preference for teaching

in the traditional rather than VTE environment declined by 13 percent after the initial VTE experience.

In contrast to the military instructors in Rupinski's study, Defense Language Institute instructors became enthusiastic about VTE use. Although initially anxious and fearful about VTE, these instructors became VTE champions, seeing the technology as a tool for innovative classroom instruction. One instructor's comment sums up the DLI instructor attitude: "It's (VTE) incredible, it's fantastic, heavy. It's like riding in a Ferrari or a Maserati" (Biggs, 1994, p. 40). Apparently, these enthusiastic instructors were part of a larger group (how much larger was not clear) who had started with VTE. The report pointed out that VTE had not been successful for everyone in the initial group.

Instructors reporting on their VTE experiences at the Defense Acquisition University Training and Education Conference and the Association of Business Communication International Conference were enthusiastic supporters of the technology. They saw VTE as an opportunity to enrich and expand their repertoire of teaching skills and the means to provide them with a new sense of achievement through participation in a novel approach toward education.

Evaluation Is Needed Throughout the VTE Course

Given the multitude of variables that can affect the successful outcome of a VTE course, researchers emphasize the importance of formative evaluation to make informed changes to the system (Schall & Stuart, 1993). This is important during the early stages of system development and especially important if it is an innovative application. Students should be queried frequently about the content as well as the presentation of it. Greydanus, Root & Pribyl (1991) suggest soliciting feedback often about whether or not one is being understood. The University of Wyoming has institutionalized many opportunities for feedback from their students. And, Defense Language

Institute Instructors are encouraged to keep notes on what went right and what went wrong and to share those findings with colleagues.

With respect to summative evaluation, this, too, has been a topic of research (e.g., Heinzen & Alberico, 1990; Wagner, 1993). In one interesting study, Harrison, Seeman, Behn, Saba, Moise, & Williams (1991) looked at evaluation from a systems perspective illustrating the complexity of the components of distance learning systems and, once again, implicitly arguing against the VTE as conduit view.

CONCLUSIONS

Clearly, VTE use is expanding rapidly. In state after state, political leaders are providing funding to develop distance learning networks. Currently, over 25 states are investing in interactive two-way video systems. A large number of prominent state universities--The State University of New York colleges and universities, the universities and colleges within the Oregon system, Texas A&M, Penn State, North Carolina State, to name a few--have developed or are beginning to develop robust VTE programs as well as the Navy, Army (Pishel, 1992), and the Air Force. Organizations not involved in VTE development and implementation will be seen as non-innovative.

The appeal of VTE from administrators' and policy leaders' perspectives is fairly obvious: access, new markets, and reduced costs. VTE can reach students, particularly working, part-timer students, who because of geographical and time constraints would have great difficulty taking courses on campus. That pays political dividends. Furthermore, VTE can potentially reach managers, engineers, technical specialists, and a host of other knowledge workers at their worksites who need

continuing education, adult education, and managerial development courses to develop new skills necessary to deal with rapid organizational change. Offering tailored education and training to these people at their work sites will improve universities' financial bottom lines. Just as importantly, organizations need to seek out universities and establish collaborative relations with them so as to bring the best research, knowledge, and teaching practices into the workplace.

Despite the increasing use of VTE, research in this area is still in its infancy. Most studies use relatively unsophisticated research designs, examine classes that are largely lecture-based, and use verbal information recognition (fill-in-the-blanks and multiple choice question test scores) as measures of effectiveness. Perhaps what is most problematic is the lack of theoretical frameworks applied to VTE research, thus making it difficult to generalize from the research or to understand connections with other research areas such as learning theory or media choice.

VTE researchers have narrowly conceptualized its use, viewing it primarily as an information conduit. As we have shown, viewing VTE as a conduit influences system design, support, training, measures of effectiveness, and ultimately rules about VTE and its use.

The Conceptual Scheme of VTE use we propose is both an attempt to map the complex influences that drive thinking, behavior, and attitudes toward VTE and a means of making VTE instructors and administrators more self-conscious about the impact of their mental models about learning and teaching methodology. Using this VTE scheme or some other is essential if VTE administrators are to avoid costly VTE system design and human resource errors. Finally, there are five major "Lessons Learned" that we can take away from VTE research despite the flaws we have noted.

1. Teaching in the VTE classroom is <u>not</u> the same as teaching in the traditional

resident classroom; instructors need special skills to be "camera friendly," to create instructional materials that make best use of the technology, and to generate interaction so that higher levels of learning can take place.

2.Instructors need special training before launching a VTE course so that they are skilled in interacting with both the students and the media.

3. Instructors need more preparation time before offering a VTE course. The large amount of up-front planning of instructional content, the need to prepare VTE specific materials, the necessity of VTE trial runs, and the arrangement of logistics support at remote locations require large expenditures of instructor time.

4. VTE Instructors need more support. Specifically, they require technical, graphics, and clerical support to help generate the interactivity that their learning objectives require. In fact, a team-based design may be needed to prepare well for VTE offerings.

5. VTE instructors need to design into their VTE courses continuous feedback and evaluation. Continuous feedback enables instructors to generate their own set of lessons learned, to be able to communicate those lessons to other VTE instructors, and to be making corrections from class to class so as to better serve their students.

VTE is meeting a need that reflects a new way of thinking about education. Many traditional universities are changing to meet this need. Universities and organizations that do not adapt may not only miss a valuable market opportunity, but may well end up dinosaurs in a changing world. As noted by Ray Mabus:

> The day the telegraph was invented, the first reaction of the Pony Express...was to try to buy faster horses. They then tried to hire better riders. They did not realize the world had changed.[2]

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[2] Mabus, Ray. 1991. A new light in education. T.H.E. Journal, 19 (1), 53-56. Quoted by Parker Rossman (1992) in The Emerging Worldwide Electronic University. Information Age Global Higher Education. Westport, CN: Greenwood Press.

RECOMMENDATIONS

Although we reviewed a significant amount of distance learning and VTE literature, time constraints and budget restrictions made it impossible for us to conduct in-depth interviews and visit sites, like the Naval Personnel Research and Development Center in San Diego, where some of the most significant VTE work is being done. To develop a fuller understanding of VTE issues, we need to complete our review of the literature, and, most importantly, visit experimental DoD VTE sites and interview VTE system designers and research scientists at those sites.

Our "Conceptual Scheme of VTE" is a promising start to generating a model that maps complex VTE influences and affects. However, the model may lack important technical, organizational, and instructional factors that influence VTE conceptualization and use. A more extensive literature review and qualitative research in the form of interviews and site visits would result in a more robust model.

The development of a robust VTE model is essential, for it provides VTE policy makers, administrators and instructors with a road map that can help guide decisions about VTE design, support, training, rewards, measures of effectiveness, and perhaps other factors. Without a road map, VTE administrators may make VTE system and resource decisions that waste money, overwork and demoralize instructors, undermine learning, and demotivate students.

Finally, field research that employs combinations of research methodologies--qualitative and quantitative--needs to be conducted. This research should be designed to examine interactive VTE courses or modules where instructors use cases, role plays, and discussion to achieve learning goals requiring development of cognitive strategies and change in attitudes. Furthermore, this research

should examine student learning and satisfaction after repeated exposure to VTE. Finally, senior executives, who may have extensive teleconferencing experience, should be the target audience for this work; we currently know very little about this group's reaction toward VTE.

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